able path of the storm to be determined with greater certainty than can be done under the present arrangements. Telegraphic communication to Port Blair would hence tend to make the work of storm-warning more exact and trustworthy, and enable the Meteorological Department to state with greater certainty than at present the probable path or intensity of storms approaching the Bengal and Madras coasts. It would also give certain and strong indications of the formation of storms in the Andaman Sea, and enable the Department to warn the Burmah coast more efficiently than at present.

PROF. DUBOIS, of Berne, has been lately studying the physiological action of electric currents and discharges (*Arch. des Sciences*); and he has some interesting observations on the human eye, which, it is known, has luminous sensations under the action of galvanic currents. Sudden variations of intensity, especially at making and breaking the circuit, produce such flashes. With a moistened plate at the nape of the neck, and a pad on the eye, a slight flash was distinctly perceived even with a Leclanché cell of about 1·20 volt, and measuring in the galvanometer 4/100 of a milliampere. Raising the intensity to five-tenths, the observer could tell which pole was applied to the eye. On the other hand, the retina responds much less readily to discharges from condensers or induction coils. Not till a capacity of 0·037 microfarad and a tension of 21 volts was reached, was a true retinal flash perceived; and not even with 10 microfarads were the durable sensations characteristic of the two poles produced. The retina reacts to quantity.

AN important new mineral, titanate of manganese, $MnTiO_3$, isomorphous with the well-known titanate of iron or titanic iron ore, $FeTiO_3$, has been discovered in the neighbourhood of Harstigen by Dr. Hamberg, and is described by him in the current number of the *Geol. Foeren. i. Stockholm* (12 Band, 598). The crystals were found embedded in calcite, and were readily isolated by removing the latter by means of dilute hydrochloric acid, the titanate of manganese being but very slightly attacked by acids. They were of tabular habitus, and possessed an exceptionally brilliant metallic lustre of a deep red tint. In thin sections the colour is seen to be orange-red, and is not pleochroic. When ground to powder a yellow ochre is produced, possessing a slight tinge of green. The crystals are as hard as apatite, and have a specific gravity of 4·537. They consist of almost pure manganous titanate, containing 50·49 per cent. of titanium dioxide and 46·92 per cent. of manganous oxide. Like titanic iron ore, the crystals belong to the rhombohedral-hexagonal system, the basal plane (0001) being the principal face, upon which the crystals are tabular. The edges of the tables exhibit faces of the negative rhombohedron $(02\bar{2}1)$, and the deuteroprism $(11\bar{2}0)$. The angle of the rhombohedron is very near that of titanic iron ore, and if the ratios of the axes of the two compounds are compared the similarity is very striking indeed. In the case of titanate of iron $a : c = 1 : 1·385$, and in the new mineral $a : c = 1 : 1·369$. Indeed, the isomorphism is even more complete, for titanic iron ore is not only rhombohedral, but is also tetartohedral; and a study of the corrosion figures produced by boiling hydrochloric acid upon the basal plane of titanate of manganese shows that this mineral is likewise tetartohedral. The optical properties of the new mineral are also rather remarkable. The refractive index of the ordinary ray for sodium light is no less than 2·4810, almost as high as the refractive index of the diamond, for the extraordinary ray somewhat less, 2·21. The dispersion is likewise large, the respective indices for the lithium red and thallium green rays being 2·44 and 2·54 respectively. The crystals cleave readily parallel to the rhombohedral and prism faces. Dr. Hamberg gives the name pyrophanite to the mineral. He is of opinion that specular iron ore, hæmatite, Fe_2O_3, which he writes $FeFeO_3$, is also truly isomorphous with pyrophanite, and this assumption is certainly supported by the similarity of the axial ratios, those of hæmatite being $a : c = 1 : 1·359$. The ruby and sapphire, Al_2O_3, may perhaps also be included in the series, for their axial ratios are almost identical with those of pyrophanite, $a : c = 1 : 1·363$. Hæmatite, crystallized alumina, pyrophanite, and titanic iron ore, would thus form an isomorphous series with gradually ascending axial ratios.

THE additions to the Zoological Society's Gardens during the past week include a Serval (*Felis serval* ♀) from East Africa, presented by Mr. D. Wilson; two Red-backed Weaver Birds (*Quelea sanguinirostris*) from West Africa, presented by Mrs. Hastings; a White Frog (*Rana temporaria*, var.), British, presented by Mr. W. Hannaford; a Rhesus Monkey (*Macacus rhesus* ♂) from India, a West African Python (*Python sebæ*) from West Africa, deposited; a Snow Leopard (*Felis uncia*) from the Himalayas, a Collared Peccary (*Dicotyles tajaçu* ♀) from South America, two North American Turkeys (*Meleagris gallo-pavo* ♂ ♀) from North America, six Shore Larks (*Otocorys alpestris*), British, purchased; a Yellow-footed Rock Kangaroo (*Petrogale xanthopus* ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

PHOTOGRAPHIC SPECTRUM OF THE SUN AND ELEMENTS. —The *Johns Hopkins University Circular*, No. 85, issued last month, contains Prof. Rowland's report of progress in spectrum work. The spectra of all known elements, with the exception of a few gaseous ones, or those too rare to be yet obtained, have been photographed in connection with the solar spectrum, from the extreme ultra-violet down to the D line, and eye-observations have been made on many to the limit of the solar spectrum. A table of standard wave-lengths of the impurities in the carbon poles extending to wave-length 2000, has been constructed to measure wave-lengths beyond the limits of the solar spectrum. In addition to this, maps of the spectra of some of the elements have been drawn up on a large scale, ready for publication, and the greater part of the lines in the map of the solar spectrum have been identified. The following rough table of the solar elements has been constructed entirely according to Prof. Rowland's own observations, although, of course, most of them have been given by others :—

Elements in the Sun, arranged according to Intensity and the Number of Lines in the Solar Spectrum.

According to intensity.		According to number.	
Calcium	Zirconium	Iron (2000 or more)	Magnesium (20 or more)
Iron	Molybdenum	Nickel	Sodium (11)
Hydrogen	Lanthanum	Titanium	Silicon
Sodium	Niobium	Manganese	Strontium
Nickel	Palladium	Chromium	Barium
Magnesium	Neodymium	Cobalt	Aluminium (4)
Cobalt	Copper	Carbon (200 or more)	Cadmium
Silicon	Zinc	Vanadium	Rhodium
Aluminium	Cadmium	Zirconium	Erbium
Titanium	Cerium	Cerium	Zinc
Chromium	Glucinum	Calcium (75 or more)	Copper (2)
Manganese	Germanium	Scandium	Silver (2)
Strontium	Rhodium	Neodymium	Glucinum (2)
Vanadium	Silver	Lanthanum	Germanium
Barium	Tin	Yttrium	Tin
Carbon	Lead	Niobium	Lead (1)
Scandium	Erbium	Molybdenum	Potassium (1)
Yttrium	Potassium	Palladium	

Doubtful Elements.

Iridium, Osmium, Platinum, Ruthenium, Tantalum, Thorium, Tungsten, Uranium.

Not in Solar Spectrum.

Antimony, Arsenic, Bismuth, Boron, Nitrogen, Cæsium, Gold, Indium, Mercury, Phosphorus, Rubidium, Selenium, Sulphur, Thallium, Praseodymium.

With respect to these tables Prof. Rowland adds :—"The substances under the head of 'Not in the Solar Spectrum,' are often placed there because the elements have few strong lines or none at all in the limit of the solar spectrum when the arc spectrum, which I have used, is employed. Thus boron has

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only two strong lines at 2497. Again, the lines of bismuth are all compound, and so too diffuse to appear in the solar spectrum. Indeed, some good reason generally appears for their absence from the solar spectrum. Of course, there is little evidence of their absence from the sun itself; were the whole earth heated to the temperature of the sun, its spectrum would probably resemble that of the sun very closely."

The powerful instrument used at Baltimore for photographing spectra, and the measuring engine constructed to fit the photographs so that its readings give the wave-lengths of lines directly within 1/100 of a division on Angström's scale, give the foregoing results a weight superior to many others published.

A VARIABLE NEBULA.—Mr. Roberts has recently shown that the nebula in Andromeda is variable (*Monthly Notices R.A.S.*, January 1891). Previous to this, the only nebula whose variability could be accepted as proved was N.G.C. 1555, in the constellation Taurus, discovered by Dr. Hind on October 11, 1852, and observed by D'Arrest four times in 1855-56, but which has since been looked for in vain by a number of astronomers.

In *Comptes rendus* for March 2, M. Bigourdan has a communication on the variability of a nebula, N.G.C. 1186, situated near Algol. Sir William Herschel discovered this nebula in 1785 (Phil. Trans., 1789, p. 247). Sir John Herschel observed it in 1831·8 (Phil. Trans., 1833, p. 376); but Lord Rosse looked for it without success in 1854 and 1864 (Phil. Trans., 1861, p. 745, and Trans. Roy. Dub. Soc., vol. ii. p. 34). On November 8, 1863, D'Arrest could not see the nebula, although he looked for it assiduously and the atmospheric conditions were most favourable. He therefore concluded that the object did not exist ("Siderum Neb.," p. 56). M. Bigourdan finds that the nebula is again visible in the position indicated by the two Herschels, viz. R.A. 2h. 54m. 20s., Decl. + 42° 10′, he having observed it on January 31 and February 26 of the present year. It is difficult to believe that this object could have escaped the scrutiny of Lord Rosse and D'Arrest in 1854, 1863, and 1864; hence the variation is probably real, and merits the attention of astronomers. The nebula may be easily found, as it is very near the binary 694 B.D + 42° (1123 G.C.), the position of which for 1891 is R.A. 2h. 58m. 6s., Decl. + 42° 29′. Photographic evidence of the variability would be most interesting.

FEBRUARY SUNSHINE.

AS everybody is aware, February 1891 was remarkable for its excessive dryness and for the absence of anything approaching stormy weather. Many will also be disposed to remember it as a month in which we had more than our ordinary share of fog, particularly during the second half, when fog seemed to be very general over the eastern and south-eastern parts of England. It will be a surprise, therefore, to learn that, in spite of the exceptionally foggy character of the month, the amount of bright sunshine which was registered, over England especially, was altogether abnormally large. And what is still more surprising is that the second half, which included the days when the fogs were reported as most dense and widespread, was very much more sunny than the first half. According to the statistics published weekly by the Meteorological Office, the average duration of bright sunshine in the twelve forecasting districts for the month of February is 89 hours in the Channel Islands, 72 hours in the south of Ireland, 46 hours in the extreme north of Scotland, and in the other nine districts it varies between 60 and 69 hours. In the period now under review, however, the recorders registered 167 hours in the Channel Islands; 126 hours in England, S.W.; 108 hours in England, S.; 102 hours in England, E., and Midland Counties; 97 hours in England, N.W.; 90 hours in Scotland, E.; 88 hours in England, N.E.; 80 hours in Ireland, S.; 73 hours in Ireland, N.; 59 hours in Scotland, W.; and 54 hours in Scotland, N. With the exception, therefore, of the West of Scotland, where there was a deficiency of one hour, every district showed a considerable excess of sunshine, England and Wales taken as a whole having 104 hours against an average of 65 hours, the increase being 60 per cent., the south-western counties showing an excess of 83 per cent.; while the Channel Islands had 88 per cent. more than the average. The records for the individual stations in the several districts are even more interesting. Out of forty-one stations the following twenty had at least 100 hours of bright sunshine for the month, the excess above the average being shown in the second column of figures. The corresponding figures for the second half of the month are given in the third and fourth columns:—

Station.	Feb. 1–28. Hours.	Excess. Hours.	Feb. 15–28. Hours.	Excess. Hours.
Jersey	167	78	120	72
Hastings ...	135	53	105	59
Plymouth ...	134	58	97	53
Torquay ...	128	?	82	?
Falmouth ...	126	50	80	37
Pembroke ...	125	48	94	51
Cirencester ...	124	55	81	42
Southamptom	123	53	88	49
Cullompton	120	54	81	43
Llandudno ...	120	56	93	58
Eastbourne ...	118	?	89	?
Stowell ...	118	?	86	?
Churchstoke	115	54	88	54
Aberdeen ...	113	?	72	?
Hillington ...	104	40	71	35
Cambridge ...	103	37	68	31
Newton Reigny	102	45	79	47
Marchmont ...	101	?	73	?
Geldeston ...	100	31	67	28
Rothamsted	100	?	71	?

A glance at the above table shows that this wonderful outburst of sunshine was not confined to the south coast stations. Llandudno had a better record than Eastbourne, Aberdeen came very near, while Newton Reigny and Marchmont, both northern stations, fall into the list of high totals. It will be seen from the second column that the average daily excess ranged from more than 1 hour at Geldeston to nearly 3 hours at Jersey. The only station in the kingdom which had a deficiency of sunshine was Glasgow, the total duration being 34 hours, or 12 less than the normal. Fort Augustus had 40 hours, but the average is not known for this station; London comes next with 42 hours, and, small as was the total, it was 5 hours above the average. Ireland did not have a large excess: Dublin, with 91 hours, was 22 hours to the good, and Armagh, with 73 hours, was 12 hours above the average; but elsewhere the normal was exceeded by from 2 to 10 hours only. The figures quoted for the month as a whole are quite exceptional for so early a period in the year; but the third and fourth columns of the table show that about three-fourths of the total sunshine was registered in the last fourteen days. Indeed, in the first week the amount recorded fell below the average in eight out of the twelve districts, and in the following week four districts were still deficient; and this fact accounts for the excess for the last fortnight at Hastings, Pembroke, and other places being actually larger than that for the entire month. During the fourteen days, 15–28, there were several stations other than those included in the above table which had from 50 to 80 hours of sunshine. At Dublin, Durham, Geldeston, and Oxford the excess was as much as 2 hours per day above the average; Llandudno and Hastings were favoured with an extra 4 hours per day, and Jersey rather more than 5 hours. For London the Meteorological Office gives 18·9 hours in the first half, and 23 hours in the second half of the month; total, 41·9. The Royal Observatory had respectively 24·2 hours and 46·5 hours; total, 70·7. The influence of the fog on the western districts is seen in the difference for the last fortnight, when the south-eastern quarter had rather more than twice as much sunshine. The Greenwich record is an excess of 29 hours on the average for the month, or a little over 1 hour per day. This is very good under the circumstances, but Londoners cannot help envying the more fortunate districts beyond the limits of metropolitan fogs; even distant Aberdeen, although entitled to less sunshine owing to latitude, having nearly three times as much brightness as western London.

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